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No. 34

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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 34

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USSR

UDC 533.6.011.55:629.7.025.1

STREAMLINE FLOW PAST THE LOWER SURFACE OF V-WINGS AT MACH NUMBERS LOWER THAN
RATED

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA
TEKHNICHESKIKH NAUK in Russian No 3, Feb 77 pp 8-12 manuscript received
16 Apr 75

GUN'KO, YU. P. and MAZHUL', I. I., Institute of Theoretical and Applied
Mechanics, Siberian Division of the USSR Academy of Sciences, Novosibirsk

[Abstract] The performance of V-wings in various geometrical configurations in a stream with the Mach number below rated was the subject of this study. The lower surface of the wing models was wedged at 10° angle and the upper surface was, under rated conditions, oriented parallel to the stream. The rated Mach number was either $N_{Ma} = 4.0$ or $N_{Ma} = 2.5$, and small deviations from that number as well as from the rated angle of attack were considered. Measurements included the pressure distribution over the lower surface at some distance from the nose and the stagnation pressure near the bottom section of the wing. The pressure factor and the pressure loss factor were calculated. The relation between the flow (pressure) field and the wing geometry was analyzed theoretically, discounting the effect of the boundary layer but involving the various similarity parameters. The close agreement between theoretical and experimental results indicates that the proposed method of evaluation is applicable when the angle of attack approaches that at which the shock separates from the wing nose while no overflow from the upper surface occurs. Figures 8; references 8: 2 Russian, 6 Western.

USSR

UDC 532.542.536.24

STRUCTURE OF A ROTATING GAS STREAM THROUGH AN ANNULAR ORIFICE AND EFFECTIVENESS
OF A TWISTED GASEOUS SHIELD

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA
TEKHNICHESKIKH NAUK in Russian No 3, Feb 77 pp 35-39 manuscript received
17 Feb 76

SHISHKIN, N. YE. and DVORNIKOV, N. A., Institute of Thermophysics, Siberian
Division of the USSR Academy of Sciences, Novosibirsk

[Abstract] Twisting a stream is a common modern technique used for intensification of the heat transfer, flow stabilization, and thrust control. A stream injected peripherally (tangentially) into a main stream of a high-enthalpy gas provides a protective shield for the inside surface of the channel walls. Here the effect of twisting a thus injected stream on the performance of the latter as a gaseous shield under quasi-isothermal conditions has been evaluated experimentally on an aerodynamic test stand consisting of a cylindrical main channel with an annular orifice for injection

of compressed air from a nozzle. The flow parameters of the injected air were measured around the orifice circle and the shielding effectiveness (temperature of the channel wall referred to temperature rise of the main stream) was determined as a function of the twist angle, the relative injection rate, and the Reynolds number. The results indicate that the shielding effect along the initial mixing zone of the channel is weaker with than without twist. Figures 6; references 6: Russian.

USSR

UDC 629.113.004

STUDY OF THE PASSIVE DANGER OF TRUCK CABINS

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 3, 1977 pp 25-28

RYABCHINSKIY, A. I. and FROLOV, V. V., Central Institute for Motor Vehicles and Engines

[Abstract] Analysis of the results of motor vehicle accidents shows that the most important parameter characterizing the passive safety of the design of a truck is the impact strength properties of the cabin. This study presents a combined mathematical and experimental investigation of the forces and strengths involved when a truck cabin rolls over, in order to develop recommendations for estimation of the impact strength properties of cabins of future models of trucks, to increase driver and passenger safety.

USSR

UDC 534.014

THE MOVEMENT OF A PILE AFTER AN IMPACT UNDER THE INFLUENCE OF HARMONIC LONGITUDINAL ROTARY PERTURBATION

Moscow MASHINOVEDENIYE in Russian No 3, May-Jun 77, pp 25-29 manuscript received 14 Jun 76

RUBIN, B. B.

[Abstract] One method of increasing the speed of driving of piles is to use spring-type vibrating hammers, combining harmonic longitudinal rotary excitation and vertical impact. The problem of calculating the movement of a hollow pile under the influence of this combined force is reduced to integration of a system of differential sixth order equations which are essentially nonlinear in the intervals between impacts. In this work, approximate analytic methods are used to construct a solution corresponding to one of the most probable modes of motion. The problem is solved under the following assumptions: the vibrating hammer and envelope are considered absolutely solid bodies; stable periodic motion is possible with a period of $2\pi/\omega$; the element being driven does not move during the flight of the impacting portion; the impact on the element is practically instantaneous and has a velocity restoration coefficient $R=0$; the axial radius of inertia of the pile is equal to its actual radius; frontal resistance can be ignored; the resistance to movement of the pile on the side surface is described by forces of dry friction. Experimental studies confirm the correctness of the calculation plan selected. References 6 Russian.

USSR

UDC 621.643.001.24

A MODEL OF THE PIPE-SOIL SYSTEM FOR DETERMINATION OF LONGITUDINAL DISPLACEMENTS OF A PIPELINE

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 5, 1977 pp 24-25

BORODAVKIN, P. P., Moscow Institute of the Petrochemical and Gas Industry, and KHIGER, M. SH., Tyumen' Industrial Institute

[Abstract] Previous works have suggested functions for description of the longitudinal displacements of pipelines in the soil. However, when the longitudinal displacements are great, these functions become inaccurate. It is suggested that these equations be replaced by a continuous three-parameter model of the pipe-soil system in longitudinal displacements, using the following equation

$$\tau(u) = \tau_1 \frac{(u(u + k))}{(u + a)^2} \cdot$$

Analysis of this expression has shown that it precisely described the results of experiments. Parameters τ , k and a , included in the expression, must be found by mathematical processing of the results of experiments according to the principle of least squares. References 5 Russian.

USSR

UDC 624.154.(571.172).003.13

THE EFFECTIVENESS OF THE USE OF PILE FOUNDATIONS IN RESIDENTIAL CONSTRUCTION IN TYUMEN'

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 4-6

LERMAN, V. M., Tyumen'grazhdanproyekt

[Abstract] In order to compare the economic effectiveness of pile and strip foundations for residential construction in Tyumen', standard plans for large panel and brick buildings of series 121, 83.1-467A, 86 and 85, currently in construction in the city, were compared. All available planning materials were analyzed (including working drawings and estimates). The figures were studied for building with monolithic low grillages for outer and inner walls, as well as monolithic high grillages for inner walls located beneath slabs of the foundation plates. It was found that pile foundations for residential buildings in Tyumen' under ordinary soil conditions are generally ineffective when prismatic 30 x 30 cm piles and low monolithic grillage are used. The use of pile foundations with high grillage does not provide any appreciable advantage, and their technical and economic indicators are similar to those of foundations with low grillages. The use of pile foundations without grillage allows the production of comparable indicators in comparison to strip foundations with pile lengths of up to 8 m (functional length 6 m). The economic effectiveness of pile foundations can be increased in the conditions of Tyumen' by the use of short piles of efficient designs, which have good load-bearing capacity under the soil conditions present at Tyumen'.

DEFORMATION OF RESIDENTIAL BUILDINGS CONSTRUCTED IN SAGGING SOILS

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 15-16

GALITSKIY, V. G., Scientific Research Institute for Foundations

[Abstract] A case history is presented of the sad results which occurred when a nine-story series Ip-447-25/65 residential building was constructed in an area with inconsistent soil quality and the soil subsequently sagged. The 162-apartment, 9-story building, 82 x 14 m in plan, consisted of three sections with transverse load-bearing walls. The foundations were strip type, consisting of precast reinforced concrete strips 3.2 m wide, laid at a depth of 3-3.5 m below the zero plan level. Studies performed in January of 1976 showed that the moisture content of the loess-like loam in the area had risen to 19-27%, the volumetric mass of the soil skeleton had decreased somewhat to 1.41-1.61 g/cm³. The loam was found to have significant sagging properties when wet, a pressure of 0.2 MPa producing sagging of 0.005 to 0.027, a pressure of 0.3 MPa -- 0.009-0.031. The sand which lay beneath a portion of the building had low natural moisture content, low density and a generally powdery composition, so that it could also sag, which was not considered in the preconstruction investigation. Geodetic studies have shown that the total sagging between 29 September 75 and 9 December 76 was 130-170 mm. Calculations based on field data produced in January of 1976 indicated that the total sagging should be 15-20 cm. Since the actual sagging between January and December of 1976 reached 12-15 cm, further sagging of 3-5 cm can be expected, meaning that no reinforcement of the soil beneath the foundation is required at the present time. In the case in question, failure to pay attention to the specific peculiarities of the geological conditions in the construction area led to a significant increase (up to 2-3 years) in the time of construction of the building, as well as an increase in its cost. This emphasizes the importance of preparation of the bases beneath foundations, even in supposedly stable soils.

DRIVING OF PILES IN PERMAFROST WITH DRILLING OF HOLES BY A STEAM VIBRATION LEADER

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77 pp 12-14

PORKHAYEV, G. V., TARGULYAN, YU. O., Scientific Research Institute for Foundations, and KOLESOV, A. A., Fundamentproyekt

[Abstract] The Scientific Research Institute of Foundations, in cooperation with Fundamentproyekt, the All-Union Scientific Research Institute for Construction and Road Machinery and Mosgazprovodstroy Trust have developed and

introduced a new method for driving of piles in permafrost involving drilling of holes with a steam vibrating leader. This combines the advantages of the most important methods of pile driving--drilling and sinking (in holes drilled by a steam needle) and drilling and driving, while essentially avoiding their shortcomings. The steam vibration leader is a tubular structure with an open lower end, to which steam is fed. A vibration driver is rigidly attached to the upper end of the leader, to impart vibrations to the leader and prevent it from "hanging" from the walls of the hole, causing it to move forward continually, following the boundary of melting. The leader thaws the ground to a distance of 2-3 cm on either side, and increases the temperature of the ground slightly for an additional 4-6 cm, causing the soil to become somewhat plastic. The method can be used in any kind of permafrost with up to 40% large lump material and individual boulders. It increases the productivity of drilling greatly and reduces its cost and labor consumption. Piles inserted in the holes drilled freeze in rapidly, hastening the total construction process. No wet processes are involved. The minimum thawing involved helps to preserve the environment.

USSR

UDC 624.131.524.4

STUDY OF THE OPERATION OF INDIVIDUAL DRILLED AND DRIVEN PILES WITH VARIOUS COMBINATIONS OF LOADS

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 19-21

KARASEV, O. V., TALANOV, G. P. and BENDA, S. F., Kiev Division of All-Union Scientific Research Institute for Hydraulic Engineering

[Abstract] A study was performed in 1974-1975 using full-scale drilled and driven piles in order to determine the influence of horizontal and vertical loads on their load-bearing capacity in the vertical and horizontal directions respectively. The studies were performed in an area in Kiev consisting of loam with a volumetric mass of 1.65-1.68 g/cm³, shear parameters $\phi^n = 18^\circ$ and $C^n = 0.18$ MPa to a depth of 6 m, beneath which was loam over 7 m thick with $\gamma^n = 1.71-1.75$ g/cm³, $\phi^n = 14^\circ$ and $C^n = 0.024$ MPa, consistency $I_L = 0.4-0.5$. Piles 600 mm in diameter and 3 m long with no spread foot and 7.5 m long with a spread foot 1600 mm in diameter were tested. The holes for the piles were drilled with a spiral type SO drill and concreted by the VPT method with grade 300 concrete of cast consistency. The piles were reinforced over their entire length with a three-dimensional framework of circular cross section with 8 rods 16 mm in diameter of class A-II steel. A cap 50-60 cm in height was concreted onto the top. The results produced showed that it is necessary to consider the influence of the actual combination of loads to be experienced by piles quite carefully. This can be done, for example, by static testing as was done in this case. The accumulated results of such tests will allow calculation methods to be developed for the future, but even at present in determining the load-bearing capacity of

pile columns for vertical loads when periodic horizontal loads (tilt, wind, and other loads) will be experienced, it can be recommended that soil resistance on the lateral surface of the column be ignored for rigid piles or considered only below the bending point of the pile for flexible piles. References 3 Russian.

USSR

UDC 624.131.395+624.131.522.3

DETERMINATION OF THE DYNAMIC CHARACTERISTICS OF THE RIGIDITY OF NATURAL FOUNDATIONS

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 32-34

LAPIN, S. K., LO Fundamentproyekt

[Abstract] The primary design characteristic of the dynamic rigidity of natural foundations is the coefficient of elastic even compression C_z which, according to construction norms and rules SNiP II-b.7-70, should be determined on the basis of test results. However, experimental determination of C_z is difficult, since there are no reliable methods for conversion of the results of experiments with small stamps to actual conditions. The studies of the author indicated that the influence of pressure on the characteristic C_z is felt only at low pressures ($\sigma < 0.05$ MPa). An example is given of the method of determining the coefficient of even elastic compression and rigidity of a foundation given the area of the base, fill depth and static pressure on the base. References 11 Russian.

USSR

UDC 624.13/15.001.83(47+44)

SOVIET-FRENCH COOPERATION IN THE AREA OF SOIL MECHANICS AND FOUNDATION CONSTRUCTION

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 43-45

VYALOV, S. S., MAKSIMYAK, R. V., MIKHEYEV, V. V. and SOROCHAN, YE. A.,
Scientific Research Institute of Foundations

[Abstract] Between 1970 and 1975, the Scientific Research Institute for Foundations and the Central Laboratory of Bridges and Highways of France have undertaken scientific cooperation in the area of "soil mechanics, planning and construction of artificial foundations for buildings and structure under difficult geological conditions." During the term of the

cooperative agreement, the Soviets have studied the mechanisms and regularities of deformation and long-term failure of soils with various types of structural connections, from coagulation to crystallization, and the operation of non-linearly deforming foundations. Joint rheological and microstructural studies have been performed, including testing of clay soils with various types of structural connections for long-term (creep and failure) deformations, including studies of changes in soil microstructure using polarization and electron microscopes. The mechanism of long-term failure of clay has been determined, causing the characteristic behavior of this material under load, a general rheological equation for the condition of the material has been produced and basic statements developed concerning the kinetic theory of strength and long-term failure of soils. The experimental portion of the studies performed has included development of experimental installations and methods of studying clay foundations under vertical loads, as well as studies of the sequence of development of deformations in clay soils and the criterion of loss of stability of these soils. The French side has studied the residual strength of solid under alternating loads, the structure of marl as a function of its mechanical properties, regularities of the flow of clay in triaxial test and the influence of the rate of deformation of soils on their strength. A colloquium is to be held, at which the problems studied and broader problems in the area will be discussed. The French and Soviet representatives and brief summaries of the reports to be read are presented.

USSR

UDC 624.074.7.012.45.046

TESTING THE LOAD-BEARING CAPACITY OF THE WALLS OF REINFORCED CONCRETE CONTAINERS OF VARIABLE THICKNESS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 3, Jun 77
pp 49-52

ZHDAKHIN, L. P., Urals Polytechnical Institute, Sverdlovsk

[Abstract] It is suggested that walls of variable thickness be designed by a kinematic method based on the theory of limiting equilibrium, also utilizing the results of studies of the functioning of plates and walls of hoppers of constant thickness. The solution of the problem is analyzed for a trapezoidal hopper wall under the assumption that the intensity of transverse loading varies linearly over the height of the wall, with longitudinal horizontal tensile forces defined as the resultant of transverse loads within the contour of adjacent elements of connected wall mechanisms and longitudinal sloping forces in each wall defined as the resultant equal to that portion of the mass of bulk material and hopper corresponding to the horizontal cross section. The influence of friction of the bulk material on the wall is ignored and the dangerous form of wall fracture (kinematic mechanism) is described by three unknown parameters. The results of investigation of a number of hopper walls confirm the possibility of extending the kinematic

method to the design of walls of variable thickness. It is recommended that a two-parameter form of wall fracture be used in practical calculations: the first of the two parameters is the unit rate of rotation of an element of the mechanism on each side of the contour, the second is a corner span crack directed along a bisector of the angle formed by adjacent sides of the same contour. The new method can yield a savings in concrete of up to 11%, in reinforcement of up to 19%, and in cost of reinforced concrete of up to 10% in comparison with the existing methods. References 7 Russian.

USSR

UDC 624.131.53

THE LIMITING STRESS STATE OF A CONNECTED WEDGE UNDER SEISMIC CONDITIONS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 3, Jun 77
pp 35-38

YAKOVLEV, P. I., Odessa Institute of Marine Engineers

[Abstract] In this article, based on equations produced earlier, calculation formulas are suggested in which the dimensionless coefficients are separated. This is important for engineering practice since it allows digital computers to be used to compose tables and graphs of the dimensionless quantities, thus greatly simplifying calculation while retaining high accuracy. The problem is stated as follows: the effective seismic pressure on the face of a wedge (slope) and the angle of application of the pressure to the face are known; define the value of seismic pressure at which the area in the soil mass of the wedge will reach the limiting stress state. The solution suggested is applicable to arbitrary angles of inclination of the faces of the slope and any angle of application of the load; the only limitation is that there must be no discontinuities in the bulk medium of the wedge. References 7 Russian.

USSR

UDC 621.186.4:621.56

STUDY OF NATURAL CONVECTION IN THE FIBER HEAT INSULATION OF REFRIGERATORS

Moscow KHOLOGIL'NAYA TEKHNIKA in Russian No 5, 1977 pp 31-35

CHUMAK, I. G., POGONTSEV, V. G., DEKHTYAREV, V. L. and BYKOV, V. N., Odessa Polytechnical Institute for the Refrigeration Industry

[Abstract] Heat convection through the fiber insulation used in refrigerators was studied by means of a specimen-heater-specimen sandwich design, in which two central heaters heated specimens of fiber, one above and one below the heaters, the fiber specimens being cooled by fluid flows above the top specimen and below the bottom specimen. By maintaining all parameters identical in both specimens, it was possible to evaluate the role of convection in the specimens of fiber insulation. It was experimentally established that with fiber diameters of 0.5-10 μm at atmospheric pressure, with a temperature difference of 5-60 K and a volumetric mass of 10-110 kg/m^3 , there were no convection currents. The absence of convection in the insulation can be explained by the great hydraulic drag presented by the fiber to the movement of air. Thus, in studies of heat transfer in fiber insulation with these parameters of the medium and insulation, the convective component of effective heat transfer can be ignored. References 8: 4 Russian, 4 Western.

USSR

UDC 621.57.044.001.4

RESULTS OF INDUSTRIAL TESTING OF THE KV-250 AMMONIA CONDENSER WITH SHAPED PIPES

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 5, 1977 pp 29-31

LEONT'YEV, G. G., RIFERT, G. V., CHAPLINSKIY, S. I., NIKITENKO, N. B., GORIN, V. YA., OMEL'CHUK, A. V. and ZASLAVER, A. YA.

[Abstract] Laboratory studies have indicated that heat transfer in ammonia coils can be increased by 40 to 60% by the use of vertical wire-profiled tubing. In order to test these figures, both experimental and series-produced models of vertical tube ammonia condensers with profiled and smooth tubes were tested. During the tests, the ammonia pressure in the condenser, its temperature at the input and output of the condenser, the temperature of the surrounding water at the input and output, the flow of liquid ammonia and cooling water, barometric pressure and temperature of the body of the condenser were measured. It was found that profiling the surface of condensation not only increases heat transfer from the film of condensate to the wall, but also, apparently, improved the diffusion coefficient of heat transfer. With an air concentration in the mixture of up

to 20%, the mean coefficient of heat transfer from mixture to wall for the profiled tube is more than twice as high as for the smooth tube. This explains the increase in heat transfer in the experimental condenser in comparison to the series-produced condenser over the entire range of change of sprinkling density. References 2 Russian.

USSR

UDC 621.4/.6:533.6

DETERMINATION OF THE OPERATING MODES OF A LIQUID-GAS JET APPARATUS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No 5, 1977 pp 60-65 manuscript received 12 Jul 76

TSEGEL'SKIY, V. G.

[Abstract] This article is a continuation of an earlier article in which the operation of a liquid-gas jet apparatus with conical fluid and gas nozzles and a cylindrical mixing chamber was analyzed from the standpoint of the thermodynamics of irreversible processes, assuming equal stagnation temperature of the gas and liquid at the intake. Based on the second law of thermodynamics and the theorem of Prigogin, which breaks down the total product of entropy in the mixing chamber into its component parts, related to the equalization of temperature, pressure and velocity of the mixed streams, the entire possible range of ejection factors as a function of flow parameters at the input of the jet apparatus is divided into three intervals: the interval of subcritical modes of operation; the interval of possible critical modes of operation; and the interval of ejection factors in which neither subcritical nor critical modes of operation can occur. The experimental data agree qualitatively with the results of thermodynamic analysis. References 4 Russian.

USSR

UDC 621.225

LINEARIZATION OF THE EQUATION OF A HYDRAULIC ACTUATING MECHANISM WITH CHOKE CONTROL

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASINOSTROYENIYE in Russian
No 5, 1977 pp 89-93 manuscript received 23 Apr 76

ZAKHAROV, YU. YE., BARANOV, V. N., BUY, V. P. and RAZZORENOV, L. A., Kaluga
Affiliate of Moscow Higher Technical School imeni N. E. Bauman

[Abstract] A study is made of a method of linearization of the equation for a tracking hydraulic actuating mechanism with choke control. The method of linearization suggested is based on the known method of successive approximations of the solution of differential equations. The radical included in the equation is expanded into a Taylor series with respect to powers of the relative pressure drop. The generating equation is the equation for an ideal hydraulic actuating mechanism. Using the example of a closed tracking hydraulic actuating mechanism, it is proven that the difference between the solution of the initial nonlinear equation and the linearized equation for the first approximation does not exceed the value of the small terms discarded in expanding the radical into a Taylor series. References 7 Russian.

USSR

UDC 621.9.62-82

INFLUENCE OF OVERLAP AND RADIAL GAP OF A CONTROL VALVE ON THE STABILITY OF A HYDRAULIC TRACKING DRIVE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
NO 4, 1977 pp 100-104 manuscript received 19 Apr 76

KLEBANOV, M. K., RABKIN, A. L. and GORETSKIY, YE. V., Kuybyshev Polytechnical
Institute

[Abstract] This work is dedicated to the analysis of the stability of a hydraulic tracking drive controlled by a four-edge valve with overlap of slots and used in metal-cutting machine tools. The stability of the drive is studied with free motion and when a single impulse acts upon it. In analyzing the stability of the device, the method of harmonic linearization of nonlinearities inherent in the drive is used. The influence of overlaps and radial gaps in the valve on the stability of the drive is studied. An example is presented in which the boundaries of stability, expressed by the boundary behavior of pressure, are determined numerically using a digital computer. References 4 Russian.

NUMERICAL CALCULATION OF THE LAMINAR FLOW OF A VISCOUS INCOMPRESSIBLE FLUID
INSIDE A CYLINDER WITH ROTATING DISKS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA
TEKHNICHESKIKH NAUK in Russian No 3, Feb 77 pp 18-28 manuscript received
19 Feb 76

DZHAKUPOV, K. P., Kazakh State University, Alma-Ata

[Abstract] The laminar flow of a viscous incompressible fluid inside a cylinder with rotating disks is an important factor in the design of many rotating machines. Here the Navier-Stokes differential equations in dimensionless cylindrical coordinates, with the angular disk velocity assumed constant and the pressure eliminated as a variable, are replaced by difference equations with second-derivative, first-derivative, and convective terms appropriately approximated. The minimum-error algorithm is now applied to the problem of two rotating disks with fluid between them and to the problem of one rotating disk at the center of the cylinder with fluid on both sides, with the appropriate boundary conditions and with axial symmetry taken into account. The flow field and the drag coefficient in the first problem are calculated numerically for many values of the Reynolds number from 1.0 to 2250 and for several values of the cylinder length-to-diameter ratio from 1.0 to 0.1, the results then being compared with those obtained by some other iterative algorithms. Figures 5; tables 2; references 10: 9 Russian, 1 German.

USSR

UDC 666.122.2:622.7

INDUSTRIAL IMPLEMENTATION OF ACOUSTICAL TREATMENT OF QUARTZ SANDS

Moscow STEKLO I KERAMIKA in Russian No 3, Mar 77 pp 16-17

POPOVA, I. I., OGURTSOV, V. G., and LEZHNEV, YU. P., State Scientific Research Institute of Glass, KOKAULIN, V. D., Ramenskoye Mining and Concentration Combine, KLASSEN, V. I., State Scientific Research Institute of Chemical Raw Materials Obtained by Mining, IBRAGIMOV, R. I., Central Asian Nonferrous Metals Industry, BAL'SHIN, M. S. and ZIL'BERMAN, V. I., State Planning and Design Engineering Bureau of Machinery, Ministry of Agricultural Machinery

[Abstract] On the basis of industrial laboratory tests, a rotovibrator has been recommended for use in sand concentrator plants. Acoustical treatment alone, with this apparatus, is adequate for argillaceous sand with film-coated grains. Subsequent flotation is necessary for sand with a high content of heavy minerals. The quality of the process is evaluated on the basis of the reduction of the Fe_2O_3 content as well as of the heavy-mineral content. Abrasive wear limits the service life of the rotor in this apparatus to about 240 h, that of the stator to 400 h. Tables 2; references 1: Russian.

USSR

UDC 539.374

THE PROBLEM OF STRIP DRAWING

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No 5, 1977 pp 131-134 manuscript received 24 May 74

GEOGDZHAYEV, V. O. and MIKHAYLOV, S. YE.

[Abstract] The problem of drawing of strip is solved as problem of planar deformation within the framework of rigid-plastic analysis. A generalization is presented of the solution of V. V. Sokolovskiy concerning the drawing of a strip on a convex matrix. This allows the influence of matrix curvature on the distribution of pressure over the matrix and on required forces to be studied. A plan is suggested allowing the angle at the entry to a convex matrix to be considered zero. This produces a solution which has no sudden changes in velocities at the rigid-plastic boundaries. A numerical solution was produced for $\alpha_2=30^\circ$, $b/a=1.25$ for a circular convex matrix. It was numerically shown that where $\Delta < 0$, the strip is actually drawn through a concave matrix with a zero angle at the entry. The suggested plan for solution of the problem of drawing of the strip can be extended to the case when there is friction along the contact curve. The material of the strip can be considered anisotropic, subject to the Mises-Hill flow condition. References 6 Russian.

USSR

UDC 666.1.189.211

STUDY OF THE PROCESS OF PRODUCTION OF GLASS FIBER BY THE CENTRIFUGAL SPINNER AND BLAST METHOD

Moscow STEKLO I KERAMIKA in Russian No 5, 1977 pp 14-16

GORYAYNOV, K. E., SERAFIMOVA, R. M., All-Union Correspondence Construction Engineering Institute, PESTSOV, V. I., RAT'KOVA, T. V. and YANSHEVA, S. S., Mosasbotermokombinat

[Abstract] One promising method of production of high quality insulation from glass staple fiber is the centrifugal spinner and blast method, which produces fine, flexible fibers with no nonfibrous inclusions, increasing the vibration resistance of the products and reducing bulk flow. Mosasbotermokombinat Insulation Combine is now beginning to produce products of staple glass fiber by this method. The production line used is a reconstructed line which earlier operated by the method of vertical steam blowing. The line now produces products of superthin fiber with diameters as little as 5 μm , volumetric masses of up to 20 kg/m^3 , annual productivity 100,000 m^3 . Production problems encountered to date include primarily variations in diameter from 6 to 10 μm and variations in length of fibers produced. It is suggested that the composition of the glass used [63% SiO_2 , 7% R_2O_3 , 9% CaO and MgO , 15.5% Na_2O , 5% B_2O_3 , 0.5% SO_3] be changed by eliminating boric acid and reducing the B_2O_3 content to 4%. It is also recommended that the maximum heating temperature be decreased from 1470 to 1430 C. These changes plus a reduction in the spinner heat temperature, currently 1100 C, should improve fiber thickness consistency and increase the service life of the spinner head from the current 2.5 days to 4 days.

USSR

UDC 621.643:620.197.5

IMPROVEMENT OF ELECTROCHEMICAL PROTECTION OF CENTRAL ASIAN MAIN GAS PIPELINES

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 5, 1977 p 23

VINOKURTSEV, G. G., Tashkent Transgaz Union, Tashkent

[Abstract] Analysis of data on the operation of central Asian gas pipelines has indicated that the best protection system is cathode polarization of all sections regardless of the resistivity of the surrounding soil. Tashkent Transgaz Union has begun basic reconstruction of the electrochemical protection system in existing gas pipelines to correspond to this recommendation.

A number of obstacles have been encountered, including the lack of instructions concerning the examination and testing of gas pipelines, standardization of the time and periodicity of electrochemical measurements, studies of buried grounding anodes, etc. Particular solutions to the problems of protection of gas pipelines in central Asia, where the soil is highly corrosive, include the use of units of several cathode stations and type PASK cathode protection converters.

USSR

UDC 621.643.001.2

POSSIBLE CAUSES FOR LONGITUDINAL FRACTURES OF GAS PIPELINES

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 4, 1977 pp 13-14

DEMCHENKO, V. G., State Gas Inspection Commission, Stavropol'

[Abstract] Longitudinal gas pipeline fractures always result from the effects of circular tensile stresses, which reveal faults in pipe metal, faults in the pipe seam produced as it is manufactured, brittleness of surfacing metal in the pipe seam, variation in pipe shape from true circular and defects introduced during construction such as scratches, dents, etc. The fact that all cases known to the author of longitudinal pipe rupture have occurred on the vertical diameter of the pipe leads him to suppose that the key element is variation from true circular shape (ovalness) of the cross section of the pipe. It is suggested that as the pipe is insulated and laid, great caution be exercised to see that it is raised no higher than absolutely necessary above its position resting on the earth beside the pipe trench. Also, longitudinal seams produced in the manufacture of the pipe should not be allowed to fall in the plane of the vertical diameter as the pipe is laid. References 7 Russian.

USSR

UDC 538.3.001.24

DISPERSED SYSTEM WITH SPHERICAL FERROPARTICLES IN A HETEROGENEOUS MAGNETIC FIELD

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY ELEKTROMEKHANIKA in Russian No 2, Feb 77, pp 200-205 manuscript received 4 Jun 74

KARAKHANYAN, L. O.

[Abstract] An approximate calculation is presented of the field and forces acting on spherical ferroparticles in a dispersed system located in a

heterogeneous constant magnetic field of a cylindrical solenoid with current I , frequently used in magnetic separators, is undertaken. The expression produced for field intensity can be used to calculate the field intensity at any point within the solenoid. Expressions are presented for the axial and radial components of magnetic field intensity. Given the expression for the intensity of the field acting on the ferroparticles, the force acting on an individual particle can then be calculated. The results produced can be used, for example, for the construction of an optimal magnetic system for a separator. References 7: 6 Russian, 1 Western.

USSR

UDC 677.72.001.2

DESIGN OF BIMETALLIC WOUND STRUCTURES

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No 5, 1977 pp 5-9 manuscript received 5 Apr 76

MAMAYEV, L. M., KUCHERENKO, V. F. and MIKHAYLUS', A. S., Dneprodzerzhinsk Industrial Institute

[Abstract] In contrast to steel cables consisting of wires of a homogeneous material, such structures as bimetallic overhead power transmission lines, antenna systems and armored cables of various types represent systems of interconnected elements with different mechanical properties and different coefficients of thermal expansion. The heating of these structures results in the development of temperature stresses, the cyclical variations in which may lead to thermal fatigue of the material and reduced long-term terminal strength. This article studies the stress state of such bimetallic wound structures considering these thermal stresses. A system of differential equations is produced establishing the relationship between external loads, temperature and total deformations of the structure. The change in elasticity moduli and coefficient of thermal expansion of the material of the wire with variations in temperature is considered. Numerical calculations are presented involving the determination of the temperature stresses in bimetallic wires. The total deformation and stresses in steel-copper cable were determined for free and restricted temperature deformations in the 0-300 C temperature range. Analysis of the results produced indicates the need to consider temperature stresses in planning and design of bimetallic wound structures. References 2 Russian.

BLAST COMPRESSION OF STEEL-COPPER POWDER MIXTURES

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA
TEKHNICHESKIKH NAUK in Russian No 3, Feb 77 pp 45-50 manuscript received
12 Jan 76

DERIBAS, A. A., ZUEV, O. A., MAN'KOVSKIY, V. V., PEREGOYEDOV, V. G., STAYER,
A. M. and SHTERTSER, A. A., Institute of Hydrodynamics, Siberian Division
of the USSR Academy of Sciences, Novosibirsk

[Abstract] The feasibility of producing a steel-copper composite with mechanical properties close to those of steel but with a much higher thermal conductivity was studied, as well as the feasibility of producing such a material or other composites by blast compression of powders in cylindrical cartridges. A mixture of ammonite and niter was used as the explosive, and copper powder with 1.0-20 μm grains in a grade 08 steel matrix with 1.0 μm - 1.0 mm grains (major fraction 50-100 μm) was used as the raw material. Compressive strains in the ingots were examined metallographically. The mechanical properties such as density, porosity, strength, yield point, and modulus of elasticity were measured before and after the sinter process as well as after extrusion. The temperature characteristic of thermal conductivity was measured by the pulse-source method and by the comparative method. The measured thermal conductivity of the composite product with a 1:1 copper-to-steel ratio, while lower than theoretical, is consistently higher than that of pure iron. The temperature coefficients of thermal conductivity are, however, approximately the same for both. Figures 7; tables 1; references 15: 6 Russian, 9 Western.

USSR

UDC 535.511.082.52

MAGNETOOPTICAL PROPERTIES OF IR GLASSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 76
pp 32-34 manuscript received 6 Feb 76

GALANOV, YE. K. and POTIKHONOV, G. N.

[Abstract] In contrast to magneto-optical studies in the visible area of the spectrum, in the IR area, primarily garnet crystals have been studied. However, due to the heterogeneity of their optical properties, small dimensions and significant temperature dependence of magneto-optical characteristics, the use of these crystals must be limited. This makes the oxygen-free type IKS glasses quite interesting, first of all because they are industrially produced; and secondly due to the fact that the magneto-optical properties of IR glasses in the infrared area of the spectrum should be much more strongly manifested than those of oxygen-containing glasses (transparent in the visible area of the spectrum). The magneto-optical properties of industrial specimens of such glasses were studied using a specially designed and constructed IG-109 polarimeter. It was found that the magneto-optical Verdet constant of these glasses is 1.5 to 2 times higher than that of oxygen-containing glasses, both diamagnetic and paramagnetic. Equations are produced which can be used to determine the Verdet constants for type IKS22 to 32 glasses over a broad spectral range. Other optical properties are also important for practical utilization of IR glasses as magneto-optical devices: the indices of refraction and absorption and the optical homogeneity. Values of the indices of refraction and absorption of IR glasses are presented in tabular form for wavelengths of 1.15 and 3.39 μm . The best magneto-optical characteristics, in combination with high optical transparency, are found for the glasses IKS22, 24 and 31. References 12: 8 Russian, 4 Western.

USSR

UDC 669.35

STUDY OF THE INFLUENCE OF MECHANICAL AND HEAT TREATMENT ON THE PROPERTIES OF AUSTENITIC DISPERSION-HARDENED ALLOYS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No 4, 1977 pp 145-149 manuscript received 8 Apr 76

RAKHSHTADT, A. G., YASHINA, T. I., LEVIN, F. L., and TOLMACHEVA, G. A., Moscow
Higher Technical School imeni N. E. Bauman

[Abstract] A study is made of the influence of mechanical and heat treatment on the properties of austenitic dispersion-hardened iron-chrome-nickel alloys. Carbon-free alloys types 17-40, additionally alloyed with molybdenum, titanium, aluminum, niobium and boron were used. It was found that cold plastic

deformation accelerates processes of breakdown of the gamma solid solution. The resistance to microplastic deformations at 20 C of the alloys studied depends little on the degree of alloying, but increases with an increase in the degree of deformation. Mechanical and heat treatment increases the relaxation stability of the alloys at 20 C in direct proportion to the compression and degree of alloying, but the maximum is reached at 350 C.

USSR

UDC 666.363:539.213+666.122:539.213

AMORPHOUS SILICA AND PROSPECTS FOR ITS USE IN THE CONSTRUCTION MATERIALS INDUSTRY

Moscow STEKLO I KERAMIKA in Russian No 3, Mar 77 pp 30-32

IVANENKO, V. N., Kharkov Construction Engineering Institute

[Abstract] Amorphous silica constitutes 30-97% of all the silica raw material available in the Soviet Union, whether in the form of opal or as part of microorganic fossils. Its sinterability depends on the amount of fusible impurities as well as on the annealing time and temperature. In the manufacture of glasses and glass-ceramics one can control the process, essentially the phase transition, by an addition of aqueous NaOH or KOH and metallic salts in amounts depending on the desired end product and its characteristics. It is thus feasible to decrease the porosity and the water absorption, to increase the density, the strength, and the frost resistance, as well as to vary the optical properties such as the degree of translucence or opaqueness and the coloration. Experimentally produced specimens and their evaluation have established the worthiness of this large natural resource. References 3: Russian.

USSR

UDC 621.777.4:621.78

SELECTION OF A THERMOMECHANICAL EXTRUSION MODE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No 5, 1977 pp 138-142 manuscript received 30 Mar 76

SEREGIN, B. M.

[Abstract] In order to develop an optimal technology for cold and warm extrusion of the parts of marine and locomotive diesel engines, studies were performed on the alloy steels 15KH, 20KH, 40KH, SHKH15, studying the resistance to deformation at various temperatures. Tests were performed according to State Standard GOST 9651-73 in the 20-700 C temperature

interval. The tensile deformation rate was 1.56 mm/min. The diameter of the gage section of each specimen was 5 mm, length 30 mm. Steel type 15KH heat-treated by heating to 740-760 C, holding 3 hours, then cooled with the furnace, has the most favorable structure for deformation, better than steels with dense perlite inclusions and plate-like grain form, even if the grain is large. References 9 Russian.

USSR

UDC 535.211

ENERGY SENSITIVITY OF THERMOPHOTOGRAPHIC PAPER IN THE UV AND VISIBLE AREAS OF THE SPECTRUM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 76
pp 54-55 manuscript received 26 Apr 76

BELOSHEYEV, V. P., PETROVA, L. I., and SEMENOV, YE. P.

[Abstract] Thermophotographic paper was suggested earlier for visualization of IR radiation. Dark blue under ordinary conditions, it is irreversibly clarified under the influence of a radiation dose at $10.6 \mu\text{m}$ of approximately $4 \cdot 10^2 \text{ J/cm}^2$. However, the paper was insensitive to existing light sources, since it can be stored for long periods of time in lighted areas. There are presently powerful light sources with high brightness temperatures, providing energy densities in the UV and visible areas significantly exceeding the threshold of sensitivity of the paper in the IR area, allowing thermophotographic paper to be used to study the distribution of the radiated energy of such sources. The energy sensitivity of this paper in the UV and visible areas of the spectrum is determined. A characteristic curve is constructed for the UV area. The experiments performed indicate that the mechanism of decoloration of the paper in the UV and visible areas remains thermal, as in the IR area, but the energy sensitivity of the paper is considerably variable with radiation frequency, being not over 0.3 J/cm^2 in the 180-300 nm range, at least 1 J/cm^2 in the visible range and about $4 \cdot 10^{-2} \text{ J/cm}^2$ at wavelengths over $2.5 \mu\text{m}$. The decrease in sensitivity of the paper in the visible area, although a shortcoming, does not prevent its use in the investigation of high temperature sources, since they radiate most of their energy in the short wave end of the spectrum. Reference 1 Russian.

USSR

UDC 666.3.022.66

CASTING PROPERTIES OF SLIPS BASED ON TANKERISSK CLAY CONTAINING HIGH QUANTITIES OF CHLORIDES

Moscow STEKLO I KERAMIKA in Russian No 5, 1977 pp 20-22

GAL'PERINA, M. K. and MAKHSUDOVA, M. T., Scientific Research Institute for Construction Ceramics

[Abstract] A study was made of the variation of casting properties of slips with the mineralogic composition of clay and the content of water-soluble salts. It was found that the casting properties of the clays studied depend on mineralogical composition, as well as the content of water-soluble chlorides in cast masses is not over 0.4 mg·eq/100 g, the moisture content of the slip should be 30-32%, and the mass content of fluidizing electrolytes should be as follows: 0.05-0.08% soda and 0.1-0.15% liquid glass.

USSR

UDC 666.7

HIGH-STRENGTH FINISH CERAMIC MADE OF MIXTURES BASED ON PHOSPHORUS SLAGS

Moscow STROITEL'NYYE MATERIALY in Russian No 5, 1977 p 33

UMAROVA, M. SH., SHOMAKSUDOV, SH. and NURULLAYEV, Z. P., Scientific Research Institute for Construction Materials Planning, Tashkent

[Abstract] A study was made of the possibility of producing finish ceramic of mixtures based on phosphorus slags. Raw kaolin clay was used as the binder and plasticizing additive. Raw material mixtures containing 50-75% slag and 25-50% clay were tested. The best results were produced from a mixture consisting of 40% clay and 60% slag. Raw material mixtures of this composition were used to produce 18-hole bricks of the standard size, which were dried under natural conditions after laboratory manufacture, then fired for 24 hours at 1000-1050 C. The finish ceramic products correspond to grade 200. The optimal compositions for masses and technological parameters developed allow finished products to be produced, corresponding to the requirements of State Standard GOST 7484-69. The results of the work will be utilized at the Chimkent Construction Materials Combine.

EXPERIMENTAL STUDY OF THE FRACTURING OF ROCK IN A VACUUM

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 3, May 77
pp 22-23

MOTOVILOV, E. A., SMORODINOV, M. I., Scientific Research Institute for Foundations, DUKHOVSKOY, YE. A., SILIN, A. A., All-Union Scientific Research Institute for Foundations, USSR State Standards Commission, and SHVAREV, V. V., Institute of Earth Physics

[Abstract] Rock specimens consisting of red tuff with monaxial compressive strength $\sigma = 4.9-6$ MPa, strong pink felsite tuff, $\sigma = 25-40$ MPa, dense basalt with $\sigma = 150-200$ MPa, gabbro with $\sigma = 170-190$ MPa and gray medium-grain granite with $\sigma = 190-220$ MPa with densities of 0.8 to 2.85 g/cm³, porosities of 1 to 37% were studied as to compressive strength in a vacuum. Studies performed on such dense materials as basalt and gabbro showed that the vacuum had no significant influence on their fracture characteristics. However, even gray granite was affected, the volume of material chipped away from the specimens under a vacuum upon impact being 15% greater than at atmospheric pressure. The decrease in strength in the rocks studied should be considered in designing drilling devices operating under vacuum conditions, and also in planning technological equipment for crushing and processing of rock. The results cannot be extended to conditions on the surface of the moon, since the presence of residual trapped gas in the rock of the moon's surface is improbable. References 6 Russian.

USSR

UDC 681.2.089.5.001.57

DETERMINATION OF THE DAMPING TIME OF MULTIPLE-ELEMENT MEASUREMENT DEVICES
AS A FUNCTION OF THEIR PARAMETERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 1, 1977 pp 30-32

PLATONOVA, E. R. and RABINOVICH, S. G.

[Abstract] The damping time is an important dynamic characteristic of measurement equipment. For multiple-element equipment, the transient processes of which are described by transfer functions with high order characteristic equations, analysis of the influence of these parameters on damping time is quite difficult. A preliminary study of one-dimensional dependences of relative damping time on each parameter allows the researcher to limit studies to second-order polynomials which have both quadratic terms and terms characterizing paired interactions. The results produced can be used to determine the coefficients of the polynomial by the method of least squares. A knowledge of the damping time for all combinations of parameters can be extracted with weights equal to unity. Considering the area of stability of operation of the autocompensator, the following ranges of change of parameters were used: $0 \leq \kappa \leq 1.0$; $0.5 \leq \beta \leq 2.6$; $0.3 \leq \beta_b \leq 1.35$; $0.1 \leq \nu \leq 0.6$. The values of rotation coefficients produced for various values of q are presented in a table. The tests performed show that for 95% of points used to determine the coefficients of the polynomial, the error of approximation was not over 40%, primarily falling between 10 and 20%. The error reached 80% for one point. These errors are acceptable for planning-stage calculations. However, the parameters of the autocompensators κ and β do not always fall with the range of change assumed; therefore, analogous coefficients were also determined for sectors corresponding to stable operation of the device. Thus, the method performed allows an analytic equation to be produced for the damping time as a function of the parameters of the measurement device. This in turn makes it possible to formalize the task of synthesis of the measurement device with assigned or minimum damping times. The possibility of limiting studies to a polynomial of not over second power allows methods of mathematical programming which have been well developed to be used to solve the problem. References 6 Russian.

USSR

UDC 531.717.5.088:621.9.08

A NEW METHOD FOR DETERMINING THE ERROR OF ACTIVE TESTING INSTRUMENTS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 1, 1977 pp 54-55

KHASIN, I. A. and ETINGOF, M. I.

[Abstract] A basically new method has been developed for determining the accuracy characteristics of instruments for testing on the linear dimensions

of parts as they are worked on metal cutting machine tools. The essence of the method is that immediately in the process of working, the displacement of the measuring jaws of the instrument is measured by means of a standard inductive converter and high-speed digital voltmeter. The method suggested was tested during working of batches of parts on a circular grinding machine with a pneumatic drive, additionally equipped with a standard inductive measurement system. As long as the processing mode remains unchanged (two batches of 25 parts each), the results of processing and the indications of the instrument are quite stable. The maximum error in working (greatest deviation of diameter of parts worked) in each batch of 25 parts was $\Delta = 3 \mu\text{m}$, the maximum error of the instrument $\delta = 0.7-0.9 \mu\text{m}$. The level of adjustment of the instrument and its error depend much less on changes in the grinding mode than the level of adjustment of the MDTP system and processing error. In all cases tested, δ was about 30% of the maximum working error.

USSR

UDC 531.715.1:53:083

INTERFERENCE METHOD OF QUALITY TESTING OF THE MAIN MIRROR OF A LARGE-AZIMUTH TELESCOPE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 76
pp 3-6 manuscript received 16 Mar 76

KOLOMIYTSOVA, T. S., KONSTANTINOVSKAYA, N. V., and GOYKO, N. A.

[Abstract] During the final stages of polishing of the main mirror of a large-azimuth telescope, the Hartman method was used in special testing sessions to evaluate the condition of the surface being worked. In addition to the shadow method, an interference method of testing of surface quality of the main mirror was used. The experience showed that the interference method was reliable in producing good quality data on the status and change in shape of the mirror surface after each polishing session. The interference picture observed on the surface of the mirror clearly showed the location of errors on the surface and allowed the magnitude and direction of deviations from the assigned form to be determined. The interference method was the primary technological control method used. Due to its clarity, it allowed rapid interpretation of the picture and evaluation of surface errors, indicating the further processing required. References 4: 3 Russian, 1 Western.

USSR

UDC 621.01

METHOD OF REPRODUCTION OF THREE-DIMENSIONAL OSCILLATIONS ON THE BASIS OF STATISTICAL CRITERIA FOR ANGULAR DISPLACEMENTS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No 4, 1977 pp 26-31 manuscript received 12 May 76

FEDOSOV, A. A., PYLAYEV, V. A., and KUZNETSOV, A. A., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] A method is studied for reproducing the three-dimensional oscillations of a body on the basis of a set of rotary motions based on statistical characteristics of the angular displacements. Sets of experimental dependences of the angles of nutation and precession are used to make a transition to a group of generalized coordinates V and Θ , related to the angles of nutation δ and precession ν by the formulas

$$V = \delta \cos \nu, \quad \Theta_p = \delta \sin \nu.$$

The realizations of angular displacements of the body V and Θ (Cardan angles) yield statistical characteristics which are defined by moment functions. In order to produce parameters allowing a criterion of adequacy of reproduction to be selected in the mode of imitation, the first order moments of the oscillations and two-dimensional central moments of sets of oscillations are analyzed. Expressions are presented for the autocorrelation and spectral density functions of the dispersions of oscillations for the modes of imitation of precession and nutation. Possible structures of formation of classes of random processes reproduced on a test stand under laboratory conditions are demonstrated. It is confirmed that when the length of the interval of imitation under laboratory conditions is increased, there is no tendency toward reduction of autocorrelation to zero. The test stand can thus reproduce the statistical characteristics describing the random processes of oscillation of bodies of the following types: unstable processes of oscillation; processes leading to stable processes in individual intervals of reproduction but not having the property of ergodicity; stationary processes having the property of ergodicity in relationship to the mathematical expectations. Modulation of the reference frequencies in the imitation mode converts the process of oscillation to the class of unstable processes, since the requirements for autocorrelation functions in sets V and Θ are not fulfilled. References 2 Russian.

CRITICAL LOAD FOR UNSMOOTH NONEQUIAXIAL ELLIPSOIDAL ENVELOPES UNDER PRESSURE

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 4, Apr 77 pp 29-33 manuscript received 4 Jul 75

BABENKO, V. I., Institute of Low Temperature Physics and Technology, Acad. Sci. UkrSSR, Khar'kov

[Abstract] Earlier works by the author have shown that the loss of stability of a near zero-moment thin linearly elastic isotropic strictly convex envelope with formation of a dent which does not contact the boundary is possible if

$$\max_{(F)} \frac{-Z + [Z^2 + 4K(T_{12}^2 T_{21} - T_{11} T_{22})]^{\frac{1}{2}}}{K} = e.$$

where $e = 3E\delta^2 / \sqrt{3(1-\nu^2)}$. For the case of evenly distributed pressure $z = -p = \text{const}$, assuming that $p > 0$ corresponds to external pressure. The equation above defines the basic asymptote of the upper critical load for infinitesimal envelope thickness. In this article, thin linearly elastic isotropic ellipsoidal envelopes are studied. Based on the results produced earlier for strictly convex envelopes, the values of upper critical loads are determined for envelopes under the influence of evenly distributed both external and internal pressure. The cases studied include: free support on a plane of symmetry of an ellipsoidal envelope; an absolutely rigid attachment of the edge of the ellipsoidal envelope, preventing displacement and rotation of points of the envelope on the tangential plane. In the former case, when related to great deformations of the edge and its vicinity; in the latter case only loss of stability at loads defined by the equation above is possible, i.e., with formation of dents which do not contact the edge. For nonuniform ellipsoids of rotation and equiaxial smooth ellipsoids, the problems studied in this article can be solved in closed form. The formulas produced agree with the formula presented above within a limit of accuracy of 5%. References 4 Russian.

USSR

UDC 539.3.214

INFLUENCE OF PRELIMINARY LOADING ON THE STABILITY OF FLEXIBLE ELASTIC-PLASTIC ENVELOPES

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 4, Apr 77 pp 34-37 manuscript received 1 Jul 75

KANTOR, B. YA. and BAYEVSKAYA, G. D., Institute of Machine-Building Problems, Acad. Sci. UkSSR, Khar'kov

[Abstract] This article studies the variation of bending and stability in large, flexible, smooth envelopes with the residual stress-strain state caused by preliminary loading. Calculations are based on a variational equation for the rates of change of the angle of rotation of the meridian and the Meisner-Lourier force functions describing the equilibrium of envelopes of rotation considering geometric nonlinearity. The theory of plastic flow with isotropic hardening is utilized. It is assumed that the components of displacements are negligible in comparison to the characteristic dimension of the envelope, while the square of the angle of rotation is comparable to deformations, which are negligible in comparison to unity. The preliminary plastic deformation of the envelope by internal pressure (within the limits studied) leads to an increase in the critical value of external pressure. This is apparently explained by the hardening of the material and the increase in the height of the loaded envelope due to residual deformations. References 4 Russian.

USSR

UDC 539.377

DETERMINATION OF THE STRESS INTENSITY FACTORS IN A PLATE WITH HEAT EXCHANGE

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 4, Apr 77 pp 66-71 manuscript received 16 Feb 76

KIT, G. S., NECHAYEV, YA. K., and POBEREZHNYY, O. V., L'vov Affiliate for Mathematical Physics, Mathematics Institute, Acad. Sci. UkSSR

[Abstract] Under actual operating conditions of structures and instruments, the elements of which consist of plates, one must consider heat exchange of the plates with the environment. In the few works in which this heat exchange is considered, an integral Fourier transform is used to solve the problem of thermoelasticity, which is possible only for the case of a straight-line crack. In the present article, a method is suggested for solution of the problem of heat conductivity and thermoelasticity for a plate with a crack of arbitrary configuration with different temperature conditions on the opposite sides of the crack. An infinite, elastic, isotropic thin plate with a notch is studied, heated symmetrically relative to the midsection

surface, including heat exchange between the lateral surfaces and the environment according to Newton's law, with temperature or heat flux assigned at the boundaries of the section. The example of a straight-line crack is used to study the influence of heat exchange of the plate and the boundary conditions on the stress intensity factors. The problem of determination of the temperature field is reduced to that of finding the unknown density of sources or dipoles, after which the temperature at an arbitrary point on the field is determined. A graph shows the variation in adjusted stress intensity factors with the parameter $\epsilon = \kappa l$. It shows that as the heat transfer increases, stress intensity factors decrease. References 20 Russian.

USSR

UDC 534.113

OPTIMIZATION OF THE PARAMETERS OF ROTATING RODS

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 4, Apr 77 pp 96-102
manuscript received 26 May 75

GRINEV, V. B. and GARAL', YA. A., Khar'kov Polytechnical Institute

[Abstract] A study is made of a rod rigidly attached to the contour of an undeformed rotating disc. The resonant frequencies and forms of bending oscillations of the rod are found by studying the boundary value problem for the differential equation

$$\frac{d^2}{dx^2} \left(EI \frac{d^2 y}{dx^2} \right) - \frac{d}{dx} \left[\frac{dy}{dx} \int_x^1 \omega^2 \rho F(x+R) dx \right] - p^2 \rho Fy = 0$$

with the boundary conditions

$$x = 0; y = \frac{dy}{dx} = 0; x = l; EI \frac{d^2 y}{dx^2} = \frac{d}{dx} \left(EI \frac{d^2 y}{dx^2} \right) = 0.$$

Here E and ρ are the modulus of elasticity and mass of a unit volume of the material; $F(x)$ and $I(x)$ are the change in area and moment of inertia of the cross section along the length of the rod; p is the resonant frequency. Pontryagin's maximum principle is used to study problems of optimization of the relative spectrum of resonant frequencies and volume of the rod. In addition to geometric limitations, the conditions of strength in the field of centrifugal forces are considered. An example is presented of calculation of optimal rods for various angular velocities of rotation. References 4 Russian.

USSR

UDC 624.011.78

STRENGTH AND DEFORMATION CAPACITY OF ELASTIC-VISCOUS-PLASTIC COMPOUND RODS
IN BENDING

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 4, Apr 77 pp 103-109
manuscript received 3 Jul 75

KORMAKOV, L. I., Kiev Construction Engineering Institute

[Abstract] A study is made of the "planar problem" of a compound rod consisting of n monolithic straight branches interconnected over their entire length by bonds, the operation of which is defined by forces and displacements arising in one of the primary planes of the cross section of all branches. The material of the branches and the bonds follows the regularities of deformation of an elastic-viscous-plastic body as time passes. The calculation formulas were generated on the basis of arbitrarily assigned functional dependences so that the solutions thus produced in general form could be applied to each specific particular case in which these equations are approximated in analytic form. Simultaneous solution of the differential equations produced defines the stress state of the compound rod. An example illustrates that with a few simplifying assumptions (infinitely rigid transverse bonding where $\eta_{tk}=\infty$, minimum number of branches $n=2$), the problem can be solved in analytic form. Solution of the problem with an arbitrary number of branches and development of elastic-viscous-plastic deformations in the transverse bonds and shear bonds requires the use of a computer. References 4 Russian.

USSR

UDC 534.1

THE BEHAVIOR OF A NONLINEAR OSCILLATING SYSTEM WITH HARMONIC PERTURBATIONS

Moscow MASHINOVEDENIYE in Russian No 3, May-Jun 77 pp 22-24 manuscript
received 5 Jul 76

LIPSKAYA, M. E.

[Abstract] The method of harmonic linearization is used to produce formulas allowing estimation of the behavior of a system consisting of a single oscillating mass with a nonlinear restoration force, viscous and dry friction and rigid supports acted upon by kinematic excitation, i.e., to determine whether the system is operating in the linear area of the restorative force, or whether seizure or impact against the stop is occurring. Simple formulas are presented for determination of the amplitude of forced oscillations in all these modes. References 2 Russian.

USSR

UDC 624.074.4075.04:69.001.5

INFLUENCE OF LOCAL PERTURBATIONS IN THE FORM OF THE MID-SECTION SURFACE ON
THE LOAD-BEARING CAPACITY OF A TRUNCATED CONICAL ENVELOPE

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 3, Jun 77
pp 25-27

GRISHCHAK, V. Z., Dnepropetrovsk State University

[Abstract] Based on an experimental study, an analysis is presented of the influence of one or two connected local "impact" dents with an amplitude no greater than the amplitude of a critical dent on the critical external pressure of local and general forms of collapse. Both horizontal and vertical alignment of the two dents are studied. The experiments, using type KH18N9 steel truncated cones, reproduced boundary conditions corresponding to "soft" sealing of the upper edge and near articulated support of the lower edge. The internal cavity was evacuated to create external pressure on the structure. Analysis of the results of the study showed that the presence of isolated and connected "impact" dents facilitates the development of local forms of collapse of shells. The size of the shells influences the critical pressure without influencing the reduction of overall load-bearing capacity of the shells. If the operating conditions of structures allow the formation of local critical dents, when there are large localized impact-type dents the design load must be correspondingly reduced. References 9 Russian.

USSR

UDC 539.370

THE THEORY OF MONOTONIC PLASTIC DEFORMATION

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 3-7 manuscript received
8 May 74

LEONOV, M. YA., RYCHKOV, B. A., and SULAYMANOV, ZH.

[Abstract] The plastic deformation of polycrystalline materials occurs primarily as a result of displacements of linear dislocations (local slip). In constructing a theory of plasticity based on the concept of slip, the actual body is replaced by a homogeneous model of a continuous medium with continuously distributed defects such as dislocation. Synthesis of the possible slip in such a medium has allowed a rather general operator $L_{\nu\lambda}$ of slip intensity ϕ_{nl} to be generated. This article utilizes the most common form of this operator, expressing the plastic shear resistance $S_{\nu\lambda}$, considering the medium to be isotropic at the initial moment in time. Variation of the constants included in the operator leads to various known and possible independent versions of the theory of slip. The most general

case is studied, in which all of the coefficients are not equal to zero. Further, monotonic deformation is studied, in which the fan of slip lines at any moment in time contains all of the fans of slip lines of preceding moments in time. Computations are performed by the method of successive approximations utilizing an electronic computer. The primary result is the proof of the following theorem: if an arbitrary monotonic load on an element of a body is assigned, the dependence between stresses and strains beyond the limits of elasticity can be defined experimentally by extension of a thin wall tube with twisting; the transition from the three-dimensional case to the planar stress state in this case is described by formulas (8) and (9) or (10) and (11), presented in this article. A practical example of calculation is presented. References: 13 Russian.

USSR

UDC 539.385

DURABILITY OF A QUASIBRITTLE BODY WITH AN INTERNAL CRACK NEAR-CIRCULAR IN PLAN UNDER CYCLICAL LOADING

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 19-22 manuscript received 30 Apr 76

PANASYUK, V. V., ANDREYKIV, A. YE., and STADNIK, M. M., Institute of Physics and Mechanics, Acad. Sci. USSR

[Abstract] Many theoretical and experimental studies have been written on the problems of determination of the durability of quasibrittle bodies with cracks under cyclical loading. However, the mathematical difficulties arising in analytic solution of this problem have prevented even approximate solution of many important problems of this class. In this work, within the framework of a method developed earlier for solution of these problems, an effective method is suggested for analytic approximate determination of the growth kinetics of a planar fatigue crack, near-circular in plan, and the durability of a body with such a crack over a broad range of values of cyclical tensile loads. In the general case the problem is reduced to the solution of a system of ordinary differential equations. A detailed study is presented of the kinetics of propagation of a crack which is near elliptical in plan and of the durability of a body with such a crack under cyclical loading consisting of compression perpendicular to the plane of the crack. A numerical example is analyzed. References 4 Russian.

FRACTURE OF A MOLYBDENUM ALLOY WITH 3.5 VOL.% TiN

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 27-32 manuscript received 8 Oct 75

TREFILOV, V. I., POKHODNYA, I. K., VASIL'YEV, A. D., MALASHENKO, I. S., MOISEYEV, V. F., and PECHKOVSKIY, E. P., Institute of Material Science Problems, Acad. Sci. UkSSR, Institute of Electric Welding imeni Paton, Acad. Sci. UkSSR

[Abstract] A number of works studying the fracture of steels have shown that the introduction of a significant quantity of interstitial phases (carbides, nitrides, oxides) to body-centered cubic metals can significantly change the nature of fracture of the material, particularly at the ductile-brittle transition point. However, the significance of such factors as the dispersion of the particles, their morphology, the volumetric content of particles, the solubility of the particle phase in the matrix and the strength of the division boundary between the matrix and the particle phase has never been fully studied. The strength of the division boundary is particularly important, since it goes far to determine the influence of secondary crack sources, for example in brittle matrices. This article presents a study of the fracture of dispersion-hardened alloys on the example of Mo+3.5 vol.% TiN, an alloy with a brittle matrix and a low strength level of the matrix-dispersed phase division boundary. In this case, good agreement is observed with the general scheme of the change in mechanisms of fracture in body-centered cubic metals, with the grain boundary or eutectic colony boundary acting as the weakened structural element in the area of ductile-brittle transition. At low temperatures (up to one-tenth of the melting point), the dispersed phase hinders crack propagation, while in the middle temperature interval (0.1-0.25 m.p.) it weakens the grain boundary and facilitates fracture between grains and layer separation, and at high temperatures (over 0.3 m.p.) it facilitates intragrain layer separation and ductile fracture by merging of microcavities. References 20: 11 Russian, 9 Western.

FATIGUE STRENGTH OF AIRPLANE PROPELLER BLADES

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 36-39 manuscript received 16 Jan 76

STEPNOV, M. N., SEREGIN, A. S., LEONOVA, O. V., SUKHOROSOV, YU. L., KULIKOV, YE. I., and DUNAYEV, E. V.

[Abstract] A search of the literature revealed no data on the fatigue strength characteristics of airplane propeller blades in the statistical

statement. Extensive experimental material has been accumulated on the results of fatigue testing of aircraft propeller blades, however, which allow the authors to apply the methods of mathematical statistics to process and evaluate the data of these studies. Various types of new, non-hardened blades were fatigue tested with symmetrical bending at loading frequencies of 40-60 Hz. The data from testing of blades of various types were statistically processed. The distribution of durability logarithms of airplane propeller blades can be satisfactorily described by the normal distribution. Errors arising when this distribution is used in calculation are in the direction of increased strength reserve. Airplane propeller blades have significant dispersion of cyclical durability, exceeding the dispersion of the results of testing of laboratory specimens. The fatigue curves of the blades are satisfactorily described by equations presented in the article, allowing accelerated estimation of the fatigue strength if results are available from testing at one stress level. References 7 Russian.

USSR

UDC 620.17:519.24

THE DISTRIBUTION OF CHARACTERISTICS OF MECHANICAL PROPERTIES AND DURABILITY OF STEEL

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 86-89 manuscript received 20 Jun 75

SOSNOVSKIY, L. A.

[Abstract] The normal distribution describes the scattering of strength characteristics of steels only in the middle zone of the distribution function. Below the 3-5% and above the 97-99% levels, the normal distribution is no longer adequate for modeling of experimental results. In order to provide a comparative evaluation of the parameters of the distribution of mechanical properties of steel based on two different hypotheses -- normal distribution and (left) truncated normal distribution, several sets of data were statistically analyzed: the ultimate strength of one melt of strain-hardened thin sheet cold rolled type KH15N9YU steel 0.4 mm thick; the strength of type 40R steel (18 mm diameter) of one melt after normalization and tempering; the durability of type KH15N9YU and U8A steels, in flat specimens measuring 10x60 mm and 0.3 and 0.4 mm thick respectively; the endurance of type 3KH13 steel from one melt after tempering. The results show that the use of the normal and truncated normal distributions to describe the mean values and standard deviations of mechanical properties produces no significant difference if the degree of truncation is comparatively slight (less than about 10%), whereas if the degree of truncation is relatively great, the parameters of the distribution calculated by the two hypotheses differ significantly. Thus, with truncation over 20% the difference between the mean values exceeds 5%, which must be considered in practice. References 8 Russian.

THE INFLUENCE OF NEUTRON BOMBARDMENT ON THE DUCTILITY CHARACTERISTICS OF METALS

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 90-93 manuscript received 18 Jun 75

YAROSHEVICH, V. D. and LAPIN, A. N.

[Abstract] According to the traditional approach to determination of the hot strength characteristics of metals under neutron bombardment, the "life" of the specimens under load is defined as the time necessary for the formation of a critical crack in the specimen, and therefore depends directly on the growth rate of cracks (micropores) formed. This approach does not consider the fact that in the process of deformation of the specimen, it is not only weakened (by the formation of pores and microcracks), but also strengthened (by deformation hardening). In the present work, a new method of approaching the problem of fracture considering both of these factors is developed and applied to explain the phenomenon of embrittlement of bombarded materials. The fracture of the material is represented as a phenomenon of loss of resistance of the specimen to smooth plastic deformation (localization of deformation). Analytic formulas are produced for uniform plastic deformation and the specific work of fracture as a function of the stresses, strain rate, micropore growth rate and density of radiation defects which act to stop moving dislocations. This approach to the problem is universal in the sense that it allows a broad range of phenomena related to this rather complex process to be explained by a common scheme without implying any additional assumptions. Another significant feature is that the process of fracture is described on the basis of rather well studied physical characteristics (flow stress, deformation hardening factor, pore growth rate). References 16: 11 Russian, 5 Western.

USSR

UDC 621.165.001.5

OBLIQUE BENDING OF TURBINE DIAPHRAGMS

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 3, 1977 pp 5-7

INGUL'TSOV, V. L., engineer, Khar'kov Turbine Plant imeni S. M. Kirov

[Abstract] An approximate method is suggested for designing of diaphragms considering the oblique bending of blades. It is assumed that the blade is not twisted, but that its cross section and loads acting on it are constant over its length. It is also assumed that the welded joint between the blade, body and rim has no compliance. An expression is produced for the circumferential force and torque acting in the plane of the diaphragm, as applied to the point of attachment of the blade to the body of the diaphragm. An ALGOL program for the M-222 computer was written to perform calculations by the method here presented. Results of calculation by the approximate method of two diaphragms are presented. Comparison of the results considering and ignoring oblique bending indicates that oblique bending leads to lower tensile stresses and higher compressive stresses. The results presented thus indicate that oblique bending has a significant influence on the nature of the distribution of stresses in the blade apparatus of the diaphragm. References 3 Russian.

USSR

UDC 621.439

INSTALLATION FOR THE STUDY OF INDIVIDUAL OPERATING CYCLES IN DIESELS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No 5, 1977 pp 102-105 manuscript received 23 Apr 76

BORONOV, G. G., NAZAROV, A. V., and PRIKHOD'KO, A. M.

[Abstract] An experimental installation at Moscow's Higher Technical School imeni N. E. Bauman has been modernized in accordance with the tasks which must be performed in the Problems Laboratory of the Department of Combined Internal Combustion Engines. The new installation is used to study the physics of processes occurring in the combustion chambers of diesels. A number of basic changes have been made in the installation, expanding the area of its possible application: the single injector system newly installed allows individual operating cycles to be studied with a residual gas factor of zero. The system is used to study processes of mixture formation, autoignition and combustion. The sensors, automatic control system and recording instruments used in the new installation are briefly described. The new installation allows air heated to 250 C with added nitrogen, exhaust gases and other components to be supplied, with the precise composition determined automatically by a gas analyzer. Fuel and working fluid pressures are determined by sensors based on tensoresistors.

The installation can determine the influence of various factors on mixture formation, autoignition and combustion in pure form, while the automatic system for synchronization and recording of experimental data assures high quality results with a single operator. References 5 Russian.

USSR

UDC 621.165.539.432

METHOD OF CALCULATION OF THE EROSION STRENGTH OF WET STEAM TURBINE BLADES

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 78-85 manuscript received 20 Apr 76

PEREL'MAN, R. G.

[Abstract] A method is presented for calculation of the erosion strength of blades, allowing the wear depth from the leading edge of the blades to be determined as a function of operating time. The method is based on the theory of erosion strength, based in turn on analysis of the interaction of two systems: the system of drops and the system resisting wear of the blades of a material which has an erosion life defined by the strength in microscopic volumes, the set of natural oscillating frequencies of the structural components and their interrelationships. The experimental characteristics of the erosion strength of type 2KH13 steel necessary for calculation are presented, as is a calculation example. References 22: 15 Russian, 7 Western.

USSR

UDC 621.165.76-146.1.001.5:533.6

THE UNEVENNESS OF THE FLOW WHICH EXCITES VIBRATIONS IN THE MOVING BLADES OF TURBINES

Kiev PROBLEMY PROCHNOSTI in Russian No 5, May 77 pp 94-96 manuscript received 17 Mar 76

LASKIN, A. S., SALIVON, N. D., and KONDRAT'YEV, V. F., Leningrad Polytechnical Institute

[Abstract] Calculation of the variable aerodynamic forces causing vibration of turbine blades is based on estimation of the degree of unevenness of the flow through the interacting blade rows. In particular, in studying the force effects of the stationary blades on the moving blades, a detailed picture must be developed of the flow structure in the axial gap. The flow beyond a blade row has an uneven structure due to the superimposition of potential perturbations and aerodynamic eddy wakes beyond the trailing edges

of the blades. This article studies the structure of the flow following a stationary blade row. The experimental data indicate that the field of velocities downstream from the stationary blade row can be represented as the superposition of two components: the potential component and the viscous component. It is shown that phase displacements of the harmonics of these field components cause the irregularity of the field to have a minimum with a certain gap between interacting blade rows. A formula is suggested for determination of this gap, which can be used for planning of turbine stages. References 4 Russian.

EQUIPMENT
Acoustical and Ultrasonic

USSR

UDC 620.179.16

ULTRASONIC MIRROR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 3, 1977 No 549734 4 Jan 74

YERMACHENKO, V. P., LUNDIN, V. L., and TRAKHTENBERG, L. I.

[Text] Ultrasonic mirror consisting of a hermetic housing with a hole one wall of which is lined with an elastic membrane, with the distinguishing feature that, for stabilizing the shape of the reflecting surface while the depth of immersion of the mirror changes, the latter is equipped with a hermetic chamber whose one part filled with fluid connects to a constant-pressure source (e.g., the atmosphere) through a tube movable along this chamber and whose empty part has two outlets: one for connecting to the hole in the housing and one for connecting through a tube and a throttle to the vacuum system.

USSR

NEW ATOMIC ELECTRIC POWER PLANTS OF THE USSR

Moscow ATOMNAYA ENERGIYA in Russian Vol 42, No 3, Mar 77 pp 236-238

KARELIN, YE. P.

[Abstract] By the end of the first year of the tenth five-year plan the power of Soviet atomic electric power plants has grown by almost 1.5 million kilowatts. The author lists these plants with a brief description. They include the Kursk, Armenian and Bilibinsk Plants which are shown in the figures accompanying the article, in addition to those which construction is continuing such as the Novovoronezh, Kalinin, Rovensk, Southern Ukrainian and Beloyarsk Plants. During 1976 the operating power units of the stations, included in the USSR Ministry of Energy, functioned stably as planned. Figures 3.

USSR

UDC 621.9.06:621.833

METHOD AND MACHINE FOR MANUFACTURE OF LARGE-DIAMETER COMPOSITE GEAR WHEEL SECTORS

Moscow STANKI I INSTRUMENT in Russian No 5, 1977 pp 10-12

KLUSHIN, A. S., SEMENOV, G. I., and KUZIN, YE. S.

[Abstract] The Kolomensk Heavy Machine-Building Plant has produced the model KU-250 machine for working of large gear sectors by a new method, eliminating the need for assembly of sectors to the gear wheels before working and thus greatly reducing the production floor area required. Turret lathes are not required, since turning of the outside diameter is replaced by working in vertical rows using end-cutting mills on the KU-250 machine. The accuracy of gear cutting is greatly increased, sectors of practically unlimited diameter can be produced, as well as geared racks. When necessary the end and joint surfaces of geared sectors can be manufactured on this same machine. The very rigid design of the machine and its ability to work sectors of any diameter allow the cutting speed to be increased, using hard alloy tools. The new method is based on three-coordinate division without rolling. In three-coordinate division, the sector is rotated by an angle about the axis representing the center of the stage, and the tool is shifted over much shorter distances to meet the rotating gear sector and but the required shape. If the axis of rotation is placed on a line of symmetry of the sector, calculation of coordinates is simplified and movements of the axis are greatly reduced. Three years of production experience have shown that the error in cutting sectors 8000 and 20,000 mm in diameter is not over 0.15 and 0.25 mm respectively. Technical characteristics of the machine are presented in table form. References 2 Russian.

USSR

UDC 621.9.06.012.3-529

THE MODEL NS33F2 HEAVY LONGITUDINAL METAL-WORKING MACHINE WITH NUMERICAL PROGRAM CONTROL

Moscow STANKI I INSTRUMENT in Russian No 5, 1977 pp 9-10

NEPRYAKHIN, A. G.

[Abstract] The NS33F2 machine, designed for working large, heavy metal parts such as the bodies of heavy turbines, features numerical program control. The machine was planned and developed at "Tyazhstankogidropress" Plant imeni A. I. Yefremov in Novosibirsk, and is capable of performing various milling and boring operations, cutting of large threads, as well as drilling of apertures up to 3800 mm in diameter according to the numerical program. Parts can be worked on 5 sides with one placement. By making the machine with a moving portal rather than a moving stage, the area occupied by the machine is

reduced by $1/3$, and a second part can be attached to the stage plate while one part is being worked. The hydrostatic guides feature low friction and therefore retain accuracy for long periods of time due to reduced wear. Parts up to 3 m in depth can be worked. The technical characteristics of the machine are presented in Table form.

USSR

UDC 62-135.001.41

TEST STAND FOR STUDY OF FLOW IN RELATIVE MOTION IN AXIAL TURBINES USING ORIENTED FITTINGS

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 4, 1977 pp 43-44

PETROV, YU. YE. and IVANOV, V. D., Scientific and Production Union for the Study and Planning of Power Units (Central Committee for Heavy Industry) -- Leningrad Technological Institute Central Party Bureau

[Abstract] A description is presented of a test stand design developed by the authors, in which measurement of flow parameters in relative motion can be performed by oriented spherical five-channel probes with three degrees of freedom of motion, i.e., the probes can be moved without stopping the rotor along and up and down in the channel and can be oriented as to flow direction. The device for movement of the probes consists of three mechanisms: one for each of the directions of motion. Each of these mechanisms includes an actuating unit and a drive unit. Diagrams of the actuating and drive units are presented. The test stand design suggested allows measurement of flow parameters in axial turbines in a way which significantly increases the accuracy of the experimental data produced and reduces the time and labor consumption of experiments and of processing of test results. All mechanisms are driven by hand, reducing the need for additional elements and power supplies (electric motors, compressed air, etc.), essentially simplifying the design of the test stand and thus increasing its reliability. All parts of the rotor are made symmetrical relative to the axis of the turbine machine, allowing dynamic balancing. References 6 Russian.

USSR

UDC 531.787.089.62

METHODS AND DEVICES FOR PRECISE MEASUREMENT OF THE DERIVATIVE OF A LINEARLY CHANGING PRESSURE

Moscow IZMERITEL'NAYA TEKNIKA in Russian No 1, 1977 pp 57-60

SAFONOV, O. A. and BITKOV, V. V.

[Abstract] A new device has been developed for precise measurement of the rate of change of a linearly changing pressure. The device includes a differential manometer, one arm of which is connected to the atmosphere, the other to the source of linearly changing pressure. The above-fluid portions of both arms of the manometer carry two electric contacts each, connected through a switching system to an electric stopwatch (a mechanical stopwatch can also be used). When the liquid closes the lower contact, the stopwatch is switched on, when it closes the upper contact -- it is stopped. The rate of change of pressure in this measurement system can be calculated by measuring the two values of pressure at the two moments in time on the

basis of the levels of the liquid in either of the two arms of the differential manometer. The measuring device has high accuracy characteristics due to the great decrease in error (at least two orders of magnitude) δt , even ignoring the dynamic errors of the differential manometer. The static pressure meter is convenient for use and provides high accuracy of measurement of the rate of linear change of pressure in the range of absolute pressures of 10^4 to $2 \cdot 10^5$ Pa and rates of change of pressure of up to 1000 Pa/s. One shortcoming is the relatively great system (or methodological) component of total error of measurement. The use of membrane-type devices for measurement of pressure differences is quite promising in this respect. References 3 Russian.

USSR

UDC 535.242.2.088

THE ERRORS IN THE INDICATIONS OF PHOTOMETERS AND PHOTOCOLORIMETERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 1, 1977 pp 35-36

ALEKSEYEVA, M. I.

[Abstract] Photometers (such as the FM58) and photocalorimeters (such as the FEK-56M) produced in the Soviet Union are primarily designed for concentration analysis, involving measurement of the transmission, optical density or other quantities linearly dependent on them. Measurement errors depend on the conditions of use of the instruments and can be determined by the experimenter for each type of measurement. Calculation of permissible errors of the instruments includes the maximum possible deviation of design dimensions resulting from tolerances and assembly technology. The error in indications of photometric instruments can be determined using a set of non-selective absorbers made of highly neutral glass. The incomplete "neutrality" of absorbers causes the error in measurement to include variations due to differences in the condition of attestation of the absorber and the actual usage conditions. Some instruments are influenced by the thickness of the absorber. The artificial increase in results of measurement for the FEKM device with the maximum possible absorber length is determined. It is found that for a water absorber with a thickness of 50 mm the transmission as measured by the FEKM instrument will be approximately 17% high. The accuracy of a test absorber is influenced by the tolerance for thickness difference within the limits of the light diameter. A table presents approximate nominal thicknesses of neutral glasses for a set of 7 absorbers calculated on the basis of the main absorption indices, and the calculated tolerances for thickness differences with an assigned value of $\Delta\tau/\tau = 0.01$. References 9 Russian.

USSR

UDC 535.853.33:522

A PLANETARY SPECTROGRAPH

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 76
pp 63-64 manuscript received 29 Mar 76

GUSEV, O. N., ZANDIN, N. G., and LOBACHEV, M. V.

[Abstract] The extensive complex of unique spectral apparatus of the 6-meter telescope (large-azimuth telescope) includes the SO-124 planetary spectrograph, an instrument with nonmoving focus ($F'=186$ m), designed for the production of spectra of the planets with large and moderate values of dispersion (4-50 Å/mm). The operating range of the instrument is 3000-11000 Å. The telescope constructs an image of the planet on the input slit, the height of which is comparable to the diameter of the image of the disc of the planet, 52 mm (corresponding to approximately one angular minute). The resolution of the spectrograph in the direction perpendicular to the dispersion allows the nature of radiation across the disc of the planet to be studied. The spectrograph is designed to operate in two positions: a continuation of the horizontal axis of the telescope and at an angle of 90° to it when the field rotation compensator is inserted. An optical diagram of the instrument is presented and its operation explained. References 3 Russian.

USSR

UDC 621.378.385

A DYE-BASED LASER WITH HIGH DIRECTIONALITY OF RADIATION

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 12, Dec 76
pp 23-25 manuscript received 3 Mar 76

ZABIYAKIN, YU. YE.

[Abstract] In spite of their many advantages (abundance of generating substances, broad range of radiation wavelengths, variety of excitation methods and ability to operate in the pulsed or continuous mode), dye-based lasers, utilizing complex organic molecules, have failed to reach the level of certain other types of lasers in such important parameters as efficiency and beam angle divergence. This work compares the solid angle characteristics of the radiation of dye solution lasers with lamp pumping using cylindrical and coaxial dye containers. The experimental results indicate that the use of coaxial containers with a thin cylindrical dye layer can significantly improve the beam divergence characteristics of the radiation generated. References 7: 6 Russian, 1 Western.

EAST GERMANY

STABILIZED HELIUM-NEON-GLASS LASER

Leipzig FEINGERAETETECHNIK in German No 6, 1976 pp 259-261

KUEHN, H., VEB Carl Zeiss JENA

[Abstract] A description is given of the results of VEB Carl Zeiss JENA development of lasers for distance measurement. The operation of the laser head is emphasized for which the basic mode is most important because of its stability and rotational symmetry. Once the single-mode operation has been produced with a piezoelectrically tunable frequency in the $\Delta v/v = 2 \cdot 10^{-6}$ range the laser frequency must then be brought into the Lamb-dip and stabilized at this value. For this the laser must already have its own high basic stability. The required frequency stability of $\Delta v/v = 1 \cdot 10^{-7}$ means a mirror spacing constant of $0.015 / \mu$ at the selected resonator length. A description and photographs of the laser head are given. At $\Delta v/v = 1 \cdot 10^{-7}$ the admissible temperature variation is $\Delta T = 0.1$ K for a coefficient of expansion of the (Invar) spacing pins of $\alpha = 1 \cdot 10^{-6} \text{K}^{-1}$. Because of the thermal insulation of the slip space from the outer heating sleeve the 0.1K temperature constant is maintained at all places in the resonator stack in spite of a strong temperature drop at the laser. The laser has a directional stability of ≈ 0.1 s/K. The frequency modulation of the laser light is so low that the coherence length of the laser remains ≥ 40 mm. Ill 9; Biblio 1.

USSR

UDC 621.57.004

DETERMINATION OF THE OPTIMAL BOUNDARIES OF TWO-STAGE COMPRESSION IN AMMONIA REFRIGERATORS

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 4, 1977 pp 16-20

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[Abstract] Results are presented from a technical and economic comparison of single and double stage ammonia refrigerators produced by Moscow's "Kompessor" Refrigeration Equipment Plant and the Penzensk Compressor Plant. The two-stage machines studied have full intermediate cooling of vapor and recooling of the liquid in an intermediate coil vessel. The technical and economic comparison indicates that the boiling plant, which is the boundary of optimal application of both single- and double-stage ammonia compressors, is significantly higher than that used in domestic refrigerators ($t_0 = -28^\circ\text{C}$). The use of single-stage compression with boiling plants below -20°C in order to simplify the operation of ammonia installations is not economical and should be allowed only in small installations with low cold productivity and small numbers of hours of operation per year. New refrigeration equipment currently being produced, with its higher technical capabilities, also has better economy than obsolete equipment currently being replaced. The planned reductions in cost of equipment will also allow lower specific total costs for the new equipment. References 3 Russian.

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EXPERIMENTAL STUDY OF THE HEAT CONDUCTIVITY OF FREONS 113V2 and 114V2

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[Abstract] An installation based on the absolute method of coaxial cylinders was developed and manufactured in order to study the thermal conductivity of brominated freons 113V2 and 114V2. The new installation allows measurements to be performed in the temperature range from -100 to $+250^\circ\text{C}$ at pressures of up to 100 bar. A schematic hydraulic diagram of the installation is presented. In order to check the operation of the installation, experiments were performed involving determination of the heat conductivity of high purity toluene in the $4-95^\circ\text{C}$ temperature interval. Variations with the most reliable available results did not exceed 1-2%. The heat conductivity of high purity brominated

freons 113V2 and 114V2 was measured near the line of saturation in the -60-+180 C and -60-+150 C temperature interval at pressures of up to 18 bar. The temperature variation of heat conductivity of the freons studied can be described by the following linear equation with an accuracy of $\pm 1\%$;
 $\lambda_t = \lambda_{30}[1 - \alpha(t - 30)]$. λ_{30} is 0.06975 and 0.06290 w/(m·K), α is $1.616 \cdot 10^{-3}$ and $2.4377 \cdot 10^{-3}$ 1/C for freons 113V2 and 114V2 respectively.
References 4: 2 Russian, 2 Western.

CSO: 1861

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